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APPENDIX.

Remarks on the Chart to Captain Toynbee's Paper at page 147.

By Staff-Commander C. George, R.N., Map-Curator R.G.S.

The chart of a portion of the Southern hemisphere, which accompanies Captain Toynbee's paper, represents about one-tenth of the data which he collected during five consecutive voyages from England to India. The observations which he made in the North Atlantic, South Atlantic, and Indian Oceans, are being projected, and will form a supplement to the above. Fully to delineate the whole of his observations would require two charts of each part—one of them to show the surface-temperature, currents, and winds; and the other the barometric pressure, temperature of air, and specific gravity of water.

The *blue* contour lines represent the limits of the cold or ice-bearing current; the *red* ones those of the warm current, or that derived from tropical regions, as far as Captain Toynbee has examined them. The sloping *black* figures denote the temperature of the surface in precisely the same manner as the soundings represent the depth of water on an ordinary chart. It must be understood that the cold current comes from the westward, and the chart shows that its northern boundary in August and September is between the parallels of 39° and 42° s.,; also that the warm current flows from the Indian Ocean in a south-westerly direction.

Off the Cape of Good Hope the two currents meet near the parallel of 39° s. and the meridian of 20° E., but the line of meeting may alter along that parallel in different seasons. The apparent effect of the junction of the warm and cold currents is to drive the latter about 2 degrees further to the southward, and also to divide each of the currents into two parts: some portion of the cold current is turned to the northward, and by its specific gravity it runs under the warm current, strikes the western side of the Agulhas Bank and comes to the surface near Table Bay, where its temperature is 52°, while at 60 miles off the shore the warm current is running north-westerly at a temperature of 68° to 70°—a difference of 16 to 18 degrees. At this meeting of the currents the greater portion of the warm current continues to flow to the westward, between the Cape and the parallel of 39°; while some portion of the warm current is here turned, and carried to the eastward by the cold or ice-bearing current, which, after sending off a portion towards the Cape of Good Hope, continues its easterly direction along the parallels of 40° and 42° s. The cold stream, after passing Table Bay, continues to run northerly along the west coast of Africa, and its existence has been noticed by T. Baines, Esq., F.R.G.S., at Walvisch Bay, in latitude 23° s., where he found the water so cold and bracing as to be almost unpleasant for bathing, in the same year as the observations were made by Captain Toynbee at the Cape.

That the boundary of the cold water remains somewhat stationary, as noticed by Captain Toynbee, during the months of August and September, is supported by the fact that it was found in the same locality for four consecutive years, viz., between the parallels of 39° and 40° s., and between the meridians of 4° and 6° E.; also that the warm current follows the same law is established, for on the same parallel and near 15° E., the warm current was encountered and found there during the five years of examination, and in like manner in many other places. After passing the meridian of 25° E., the cold current is pushed 2 degrees further south, and still running to the eastward carries the warm surface-water with it, as is indicated by the direction of the arrows and the contour lines of warm current stretching out in points to the eastward.

Between the meridians of 45° and 55° E., and along the parallels of 40° and 41° s., the warm and cold currents become interlaced in a remarkable manner, as may be noticed on the chart. Now that the temperatures are projected in their proper places and their contours marked out, it becomes easy to follow the cold and warm currents by their respective temperatures;* and all the remarks of Captain Toynbee are clearly illustrated, in which he says "he passed through streaks or lanes of cold and warm water, where the sea was disturbed and so confused as to roll away the main-topgallant-mast, and when hail-storms were frequent." These peculiarities invite further examination into the phenomena of the *Geography of the Sea*, with a view to ascertain what effect the meeting of the cold and warm currents has upon the atmosphere immediately over them, in other parts of the ocean.

This chart may engage the attention of the mariner when shaping his course either way round the Cape of Good Hope. Vessels outward bound, when near the island of Tristan d'Acunha, should make for the cold-water current as soon as possible, as it runs in the direction of his course; and when homeward-bound he should keep in the warm-water current for the same reason. Coming from the coast of South America, the chart would indicate that when near Tristan d'Acunha, it is safe practice to enter the cold-water current soon after passing that island, steering south-easterly between it and the cold-water patches, remarked upon by Captain Toynbee, in latitude 39° and 40° and 4° and 6° E., and keeping in that direction until they near the point where the meridian of Greenwich crosses the parallel of 43° S., in the temperature of about 46°. On this parallel (43° S.) the Cape may be passed, hauling to the northward or southward, according to the season of the year, and thus substitute the *thermometer* for the *lead.* Bear in mind the good old practice of Admiral Sir J. Norris; the three L.L.L's, viz., latitude, lookout, &c., will be a safe guide to avoid the icebergs on the south side, and to keep clear of the turmoil of the sea that may be expected along the parallel of 40° S., where the warm and cold currents mingle. Homeward-bound, keeping near the parallel of 36° S. will carry the warm current round the Cape.

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* See the 'Admiralty Manual,' Admiral F. W. Beechey's Paper, page 17, 3rd ed.

INDEX.